



Managing Knowledge at the US Space Agency

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Acknowledgements

- ♦ I am not Jeanne Holm.
but...
- ♦ Jeanne Holm leads the NASA Knowledge Management Team and is the original source for most of the material in this presentation.



Creating an Opportunity

- ◆ *Knowledge management activities provide the chance to look across an organization, regardless of boundaries, and find opportunities to make a difference...*

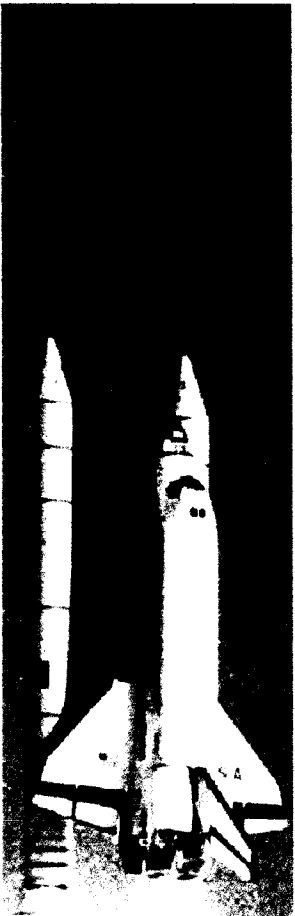


- ◆ NASA's Knowledge Management goal
 - Knowledge management is getting the right information to the right people at the right time, and helping people create knowledge and share *and act upon information in ways that will measurably improve the performance of an organization and its partners*

Why Is KM Critical to NASA?

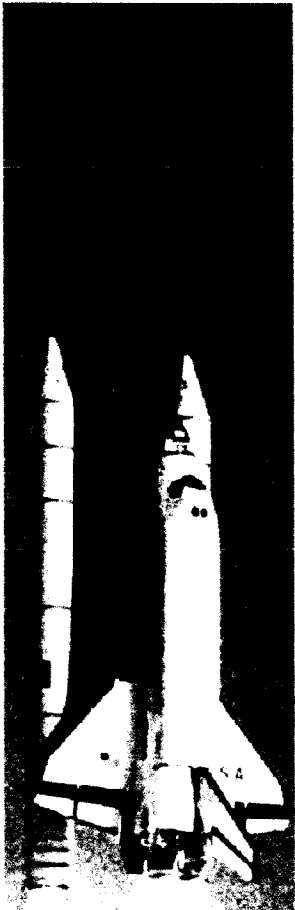
- ◆ We are constantly challenged to document and integrate our lessons learned to effectively manage the risk involved in space exploration and human space flight
- ◆ By its nature, NASA's employees have specialized knowledge
- ◆ The workforce in the Agency is aging
- ◆ Our goal is to share knowledge with each other and with the public
- ◆ *The Administration will adopt information technology systems to capture some of the knowledge and skills of retiring employees. Knowledge management systems are just one part of an effective strategy that will help generate, capture, and disseminate knowledge and information that is relevant to the organization's mission.*

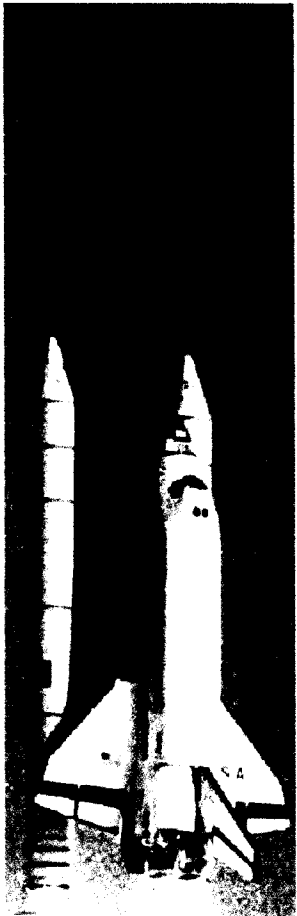
President's Management Agenda



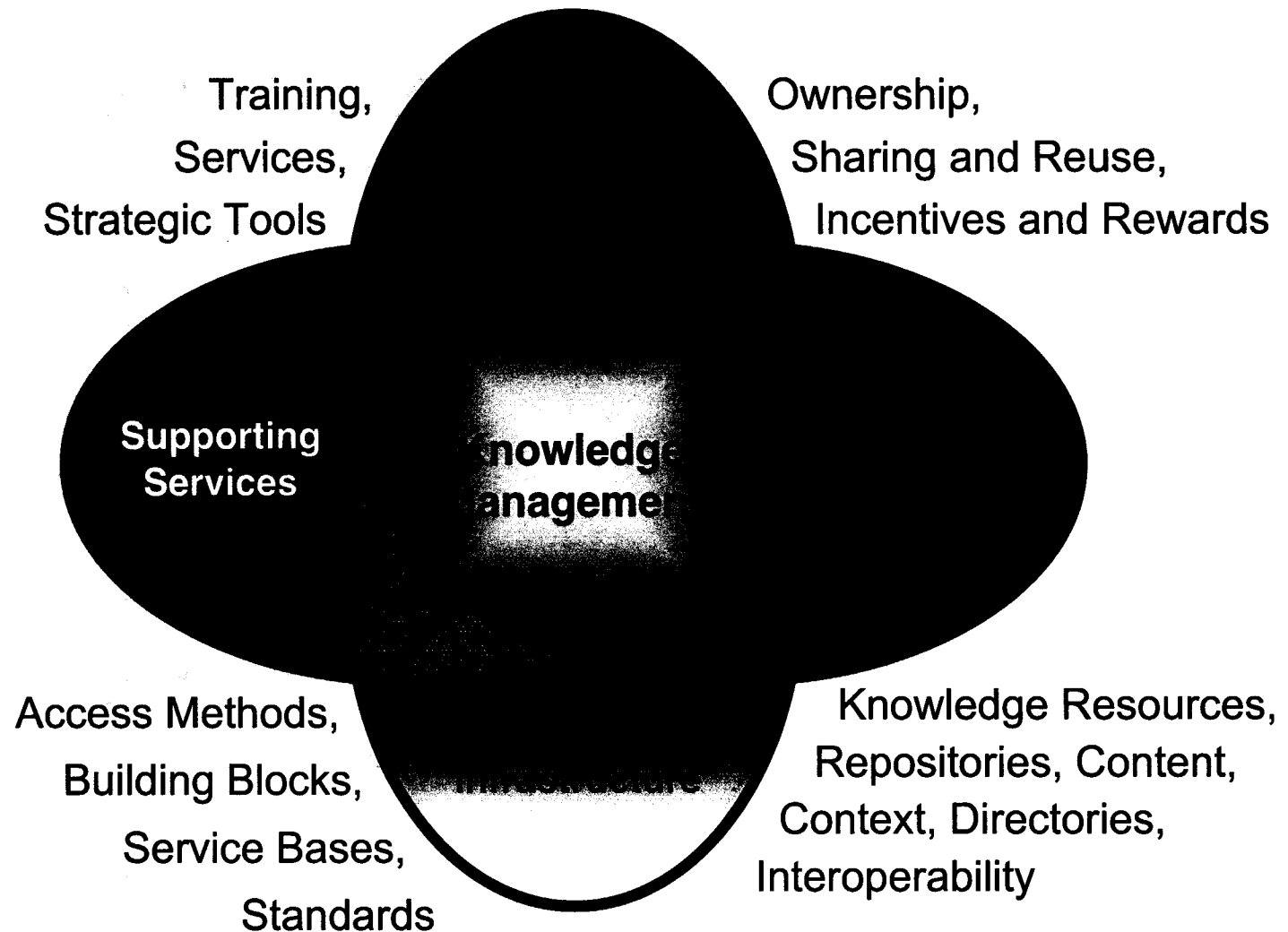
We Began Our Journey Looking Outward...

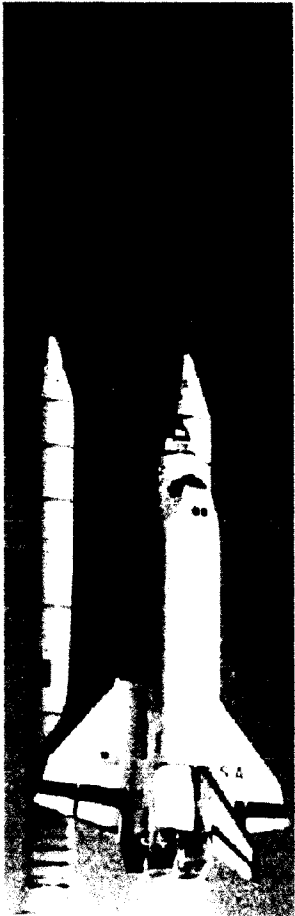
- In 1998, we reviewed 43 published case studies and visited 6 organizations to understand what others were doing in KM
 - Standard set of questions, which generally devolved into long conversations
 - Analyzed for critical success factors or reasons implementations failed or stumbled
 - Has held up over the test of time
- ◆ These organizations succeeded at KM when they were
 - Recognizing and rewarding people for sharing knowledge
 - Encouraging and supporting communities of practice
 - Balancing their long-term corporate needs (capturing knowledge) with short-term local needs (completing a task quickly)
- ◆ **Culture** was the most important factor
 - Recognize, reward, and acknowledge the importance of knowledge sharing throughout the organization





KM Critical Success Factors

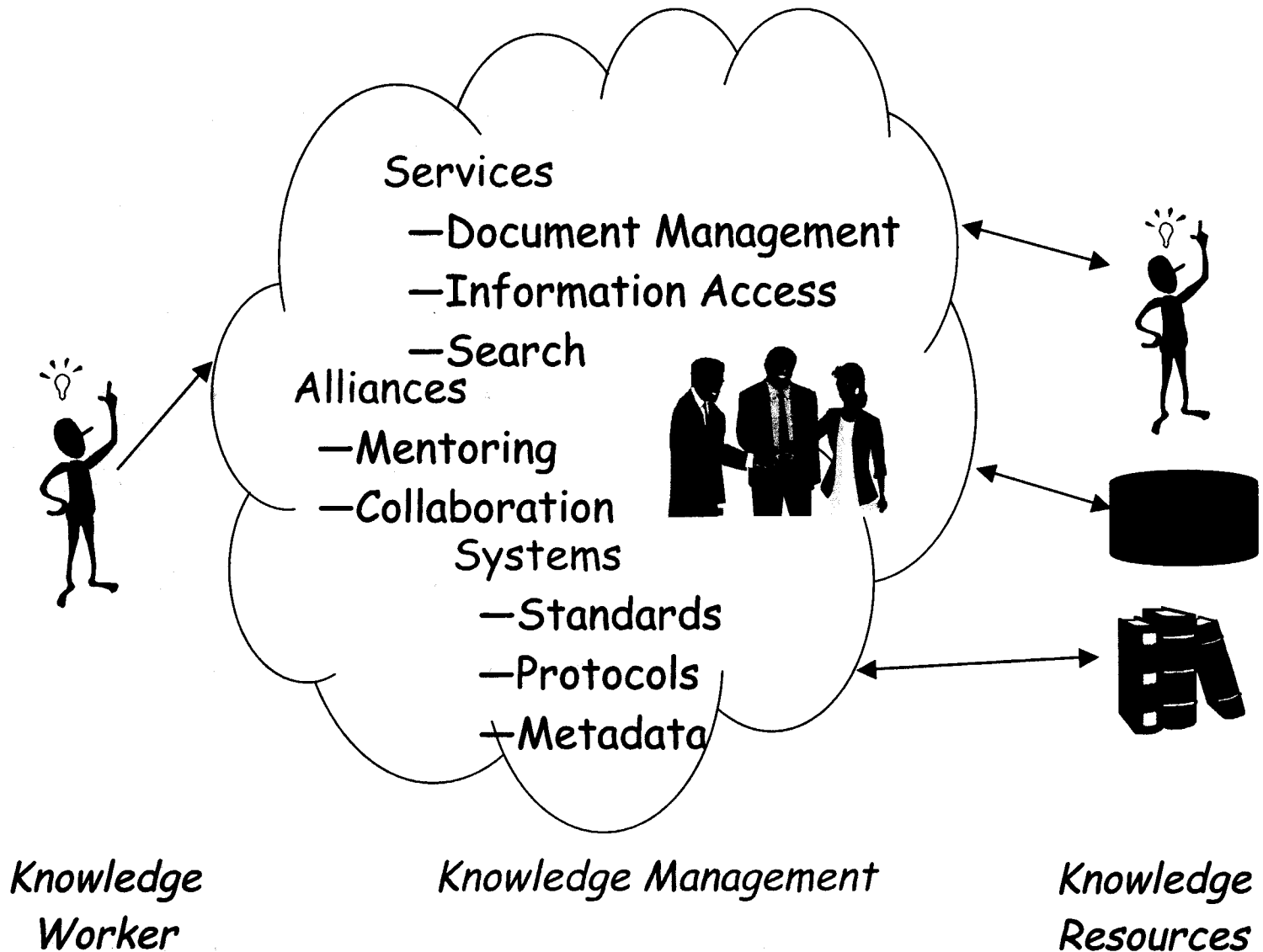




Building a KM Team

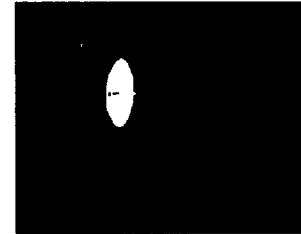
- ◆ We find good solutions, fill the gaps, and build a federation of resources to support our missions and research communities
 - KM supports and enables other processes and initiatives by advocating best practices, promoting good solutions, and building infrastructure and applications to bridge distributed systems
 - KM's goal is to help infuse new ideas or needed technology and to leave or turn over operations to the appropriate content area
- ◆ NASA's Knowledge Management Team is chartered by
 - Chief Information Officer (Paul Strassmann)
 - To embed the rules in the tools
 - Co-sponsored by Chief Engineer and Human Resources
 - To ensure the tools support the engineering processes and to affect cultural change through recognition and education
- ◆ Team members are from across the Agency, ranging from system architects to authors to anthropologists
- ◆ Actively share and benchmark with other Agencies, the National laboratory community, and academia

KM Solutions Help People Find Answers

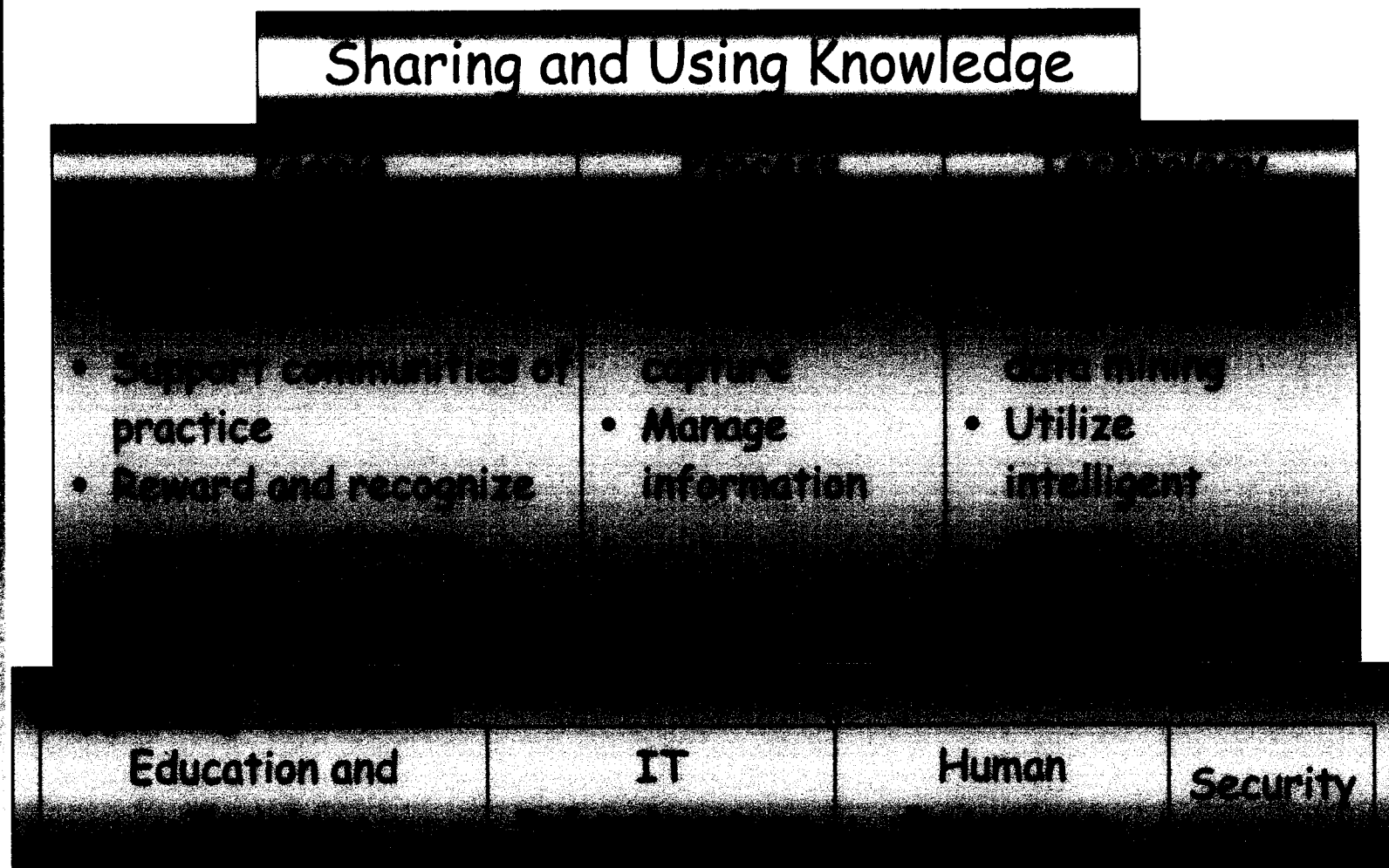
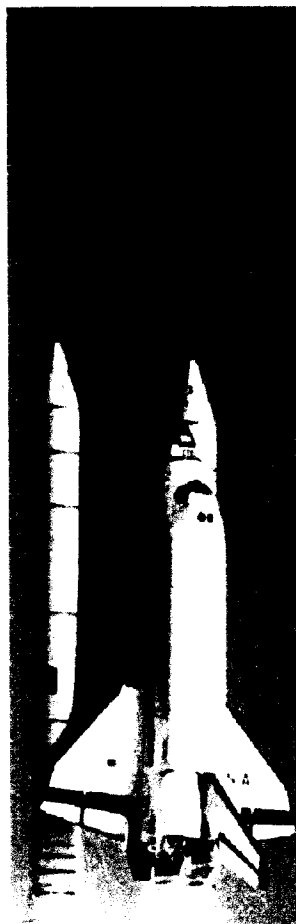


Key Areas for NASA's KM Strategy

- ◆ To sustain NASA's knowledge across missions and generations
 - KM will identify and capture the information that exists across the Agency
- ◆ To help people find, organize, and share the knowledge we already have
 - KM will efficiently manage NASA's knowledge resources
- ◆ To increase collaboration and to facilitate knowledge creation and sharing
 - KM will develop techniques and tools to enable teams and communities to collaborate across the barriers of time and space



Framework for KM at NASA



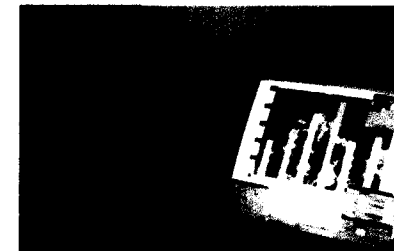
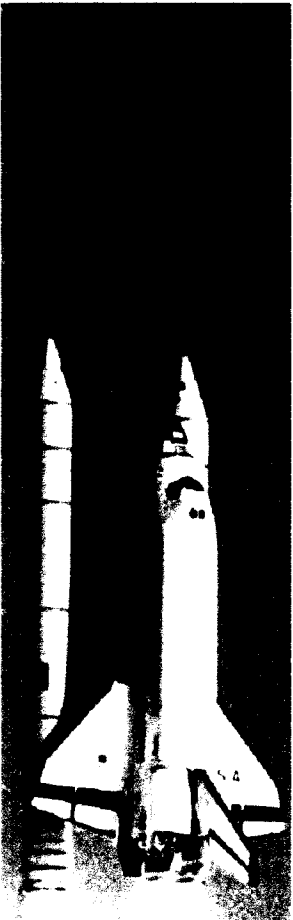


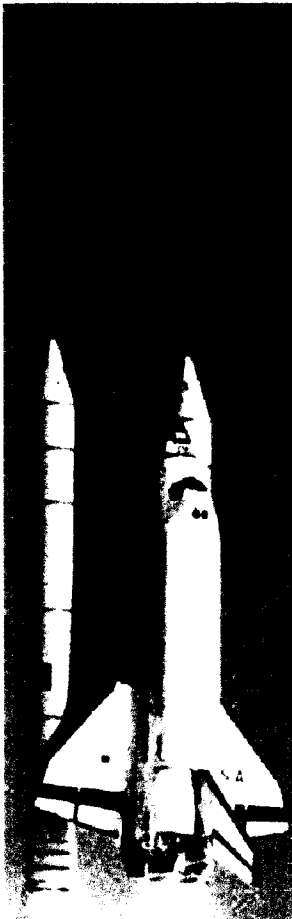
Making Progress on Knowledge Sharing

- ◆ Providing training and mentoring
 - Academy of Program and Project Leadership (APPL) hosts classes, team-targeted training, just-in-time online learning, and a community of practice for project managers
 - <http://appl.nasa.gov>
- ◆ Encouraging storytelling
 - Knowledge Sharing Initiative (storytelling) provides forums for people to share stories and publishes the best of those
 - http://appl.nasa.gov/knowledge/knowledge_home.htm
- ◆ Recognizing people for sharing knowledge
 - An Human Resource Recognition Management Study is looking at changing our incentives to encourage knowledge sharing
- ◆ Providing access to our experts
 - Integrating distributed directories within the Agency and with our partners

Making Progress (continued)

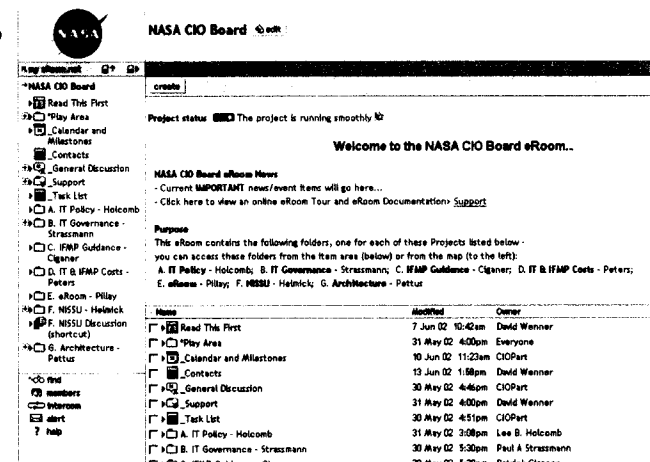
- ◆ Enhancing our ability to capture knowledge
 - Process-Based Mission Assurance collects best practices for managing our risk
 - <http://pbma.hq.nasa.gov/pbmamaster.html>
 - Redesigning our Lessons Learned Information System to encourage sharing of successes and failures
 - <http://llis.nasa.gov>
 - Creating virtual presence of key staff at reviews through our Technical Questions Database
- ◆ Rearchitecting our web environment for efficiency and effective communication
 - Content management, web shops, and enabling applications
 - <http://enasa.ksc.nasa.gov>





Deploying Systems and Services in 2002


- ◆ Easing access to information through deployment of cross-cutting information portals
 - For the public, scientists, and employees to streamline access to NASA's 4,000,000 web pages
 - Building the framework for distributed use and publishing processes
 - Creating taxonomies and metadata standards for ease of interoperability
 - <http://km.nasa.gov/portal-white-paper.html>
- ◆ Collaborative environments for missions
 - Creating access to tools and training for virtual teams
 - Quick start team environment
- ◆ Capture design knowledge
 - Creating a service and tools to capture in-process design decisions for use on current and future missions



NASA Portal in Development

See more information
at <http://km.nasa.gov>

Sample Portal



National Aeronautics and Space Administration

Inside NASA

your portal to the NASA intranet

Monday, September 9, 2002

Log Out

My Front Page

User Information

Welcome to the Jungle!
Douglas Hughes
Last Update:
September 9, 2002 12:24:45 PM PDT
119 minutes left
30 minutes max idle time

My Tools

- Employee Express
- FirstGov.gov
- Benefits Estimators

My Pay & Benefits

- Pay
- Leave and Earnings Statement
- Benefits
- Benefits Statement (NEBS)

Employee Locator

X.500 Directory

Today@NASA

Today@NASA
Understanding Earth
September 9th, 2002
Muddy Waters
September 5th, 2002
Can YOU be an Astronaut?
September 5th, 2002
Amazing Space
September 3rd, 2002
Space Power
September 3rd, 2002

LaRC Multimedia Repository

LaRC Multimedia Repository
Enter search terms : (*Search tips*)

Select multimedia type :
☒ Any ☐ Photograph ☐ Movie
Search

Browse Categories:

Aircraft


Email

NetMail Life

Mail Check

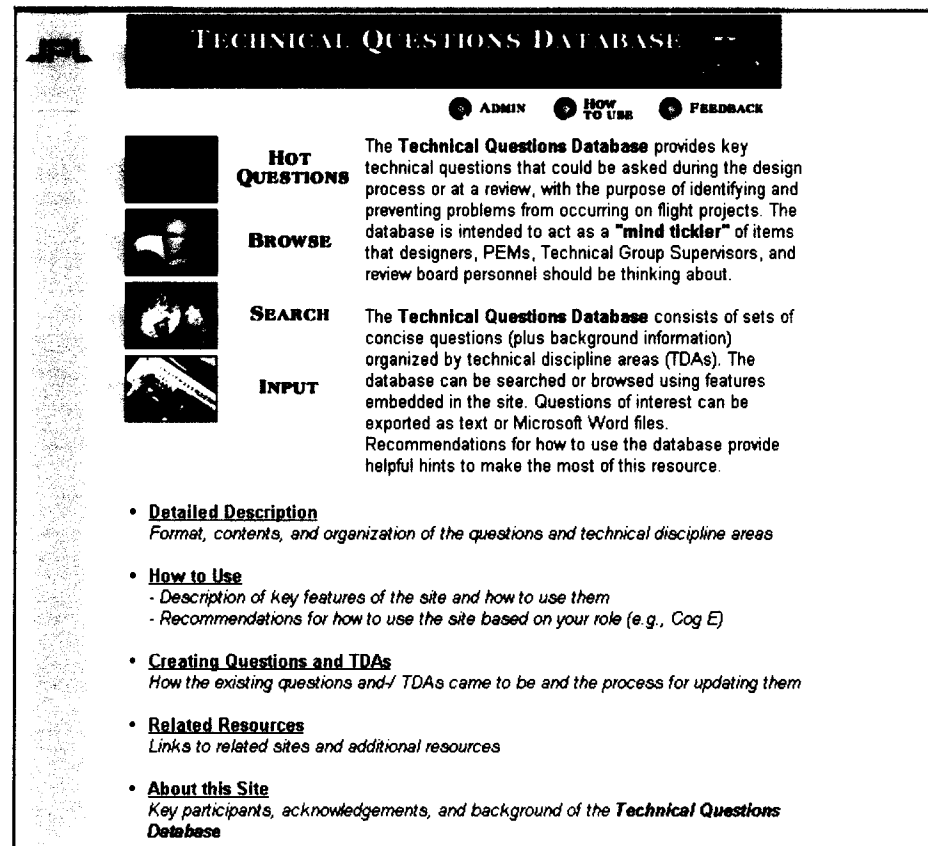
Mail Server not responding.

SpaceLink Search


Quickly jump to some of Spacelink's popular areas...
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
NASA Education Television Schedule
GO
...OR search all of NASA by entering keywords or a phrase below:

Technical Questions Database

- ◆ Best questions asked at technical reviews
- ◆ Helps to create a virtual presence when key people cannot be there
- ◆ Over 700 questions
- ◆ 42 subject areas



TECHNICAL QUESTIONS DATABASE

[ADMIN](#) [HOW TO USE](#) [FEEDBACK](#)

HOT QUESTIONS The **Technical Questions Database** provides key technical questions that could be asked during the design process or at a review, with the purpose of identifying and preventing problems from occurring on flight projects. The database is intended to act as a "mind tickler" of items that designers, PEMs, Technical Group Supervisors, and review board personnel should be thinking about.

BROWSE

SEARCH The **Technical Questions Database** consists of sets of concise questions (plus background information) organized by technical discipline areas (TDAs). The database can be searched or browsed using features embedded in the site. Questions of interest can be exported as text or Microsoft Word files. Recommendations for how to use the database provide helpful hints to make the most of this resource.

INPUT

- **Detailed Description**
Format, contents, and organization of the questions and technical discipline areas
- **How to Use**
- Description of key features of the site and how to use them
- Recommendations for how to use the site based on your role (e.g., Cog E)
- **Creating Questions and TDAs**
How the existing questions and/ TDAs came to be and the process for updating them
- **Related Resources**
Links to related sites and additional resources
- **About this Site**
*Key participants, acknowledgements, and background of the **Technical Questions Database***

Knowledge Management Roadmap



Sharing Knowledge

- Adaptive knowledge infrastructure is in place
- Knowledge resources identified and shared appropriately
- Timely knowledge gets to the right person to make decisions
- Intelligent tools for authoring through archiving
- Cohesive knowledge development between JPL, its partners, and customers

Enables sharing of essential knowledge to complete Agency tasks



- MarsNet
- Europa Orbiter
- Space Interferometry Mission



Integrating Distributed Knowledge

- Instrument design is semi-automatic based on knowledge repositories
- Mission software auto-instantiates based on unique mission parameters
- KM principals are part of Lab culture and supported by layered COTS products
- Remote data management allows spacecraft to self-command

Enables seamless integration of systems throughout the world and with robotic spacecraft



- Europa Lander/Submersible
- Titan Organics: Lander/Aerobot
- Neptune Orbiter/Triton Observer



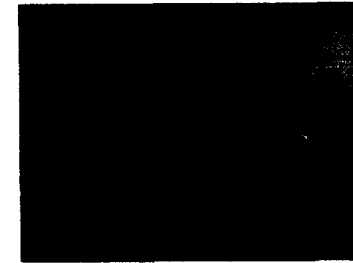
Capturing Knowledge

- Knowledge gathered anyplace from hand-held devices using standard formats on interplanetary Internet
- Expert systems on spacecraft analyze and upload data
- Autonomous agents operate across existing sensor and telemetry products
- Industry and academia supply spacecraft parts based on collaborative designs derived from JPL's knowledge system

Enables capture of knowledge at the point of origin, human or robotic, without invasive technology



- Mars robotic outposts
- Comet Nucleus Sample Return
- Saturn Ring Observer
- Terrestrial Planet Finder



Modeling Expert Knowledge

- Systems model experts' patterns and behaviors to gather knowledge implicitly
- Seamless knowledge exchange with robotic explorers
- Planetary explorers contribute to their successor's design from experience and synthesis
- Knowledge systems collaborate with experts for new research

Enables real-time capture of tacit knowledge from experts on Earth and in permanent outposts



- Interstellar missions
- Permanent colonies

2003

2007

2010

2025

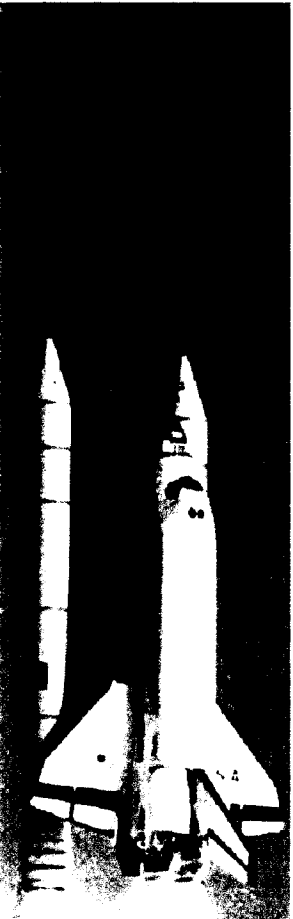
Sharing Knowledge (2003)

- **Adaptive knowledge infrastructure in place**
- **Knowledge resources identified and shared appropriately**
- **Timely knowledge gets to the right person to make decisions**
- **Intelligent tools for authoring through archiving**
- **Cohesive knowledge development between NASA, its partners, and customers**

**Enables sharing of
essential knowledge to
complete Agency tasks**

=

**MarsNet
Europa Orbiter
Space Interferometry**



Key Implementation Successes

- ◆ Get executive and/or broad sponsorship to achieve...
 - Cultural change
 - Deployment of systems and solutions
 - Infusion into the day-to-day processes
- ◆ Listen to your customers, and then listen some more
 - Make your first success the most important thing to your customers
- ◆ Keep focused on your long-term objectives, while working on day-to-day implementation
 - Think globally, act locally
- ◆ Become completely integrated to your core business
 - Avoid focusing solely on creating efficiencies
- ◆ Make an implementation choice and follow through
 - Avoid getting caught up in the latest fad
- ◆ Keep true to your vision in the face of adversity

Lessons Learned

- ◆ Enlist, encourage, empower (baptize the evangelists)
- ◆ Develop solutions, services, and rewards
 - Deliver specific solutions to specific customers
 - Build KM into the way people already do their jobs
 - Understand that cultural acceptance is key
 - Make services operational (including funding and metrics)
 - Reward knowledge sharers through promotions, recognition, and time to learn and share
 - Recognize and celebrate contributions of the KM team and others
- ◆ Keep the alliances strong
- ◆ Balance long-term desires (capturing knowledge) with local requirements (specific solutions to a problem)
- ◆ KM solutions are not “one-size-fits-all” and need to be tailored for each organization’s business and culture
- ◆ Don’t try to solve the whole problem—*just start somewhere* and solve part of the problem





Thanks!

- ◆ Many thanks to our colleagues and our partners who contributed to these ideas and to the excellent work they are doing in implementing knowledge management solutions at NASA
- ◆ If you have any additional questions, please contact
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- ◆ More information can be found about
 - NASA's KM program: <http://km.nasa.gov>
 - NASA's Missions: <http://www.nasa.gov>